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An Evaluation of Selected Production Concerns in the Alberta Dairy Industry

by

Michael John Slomp

A PAPER

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OF Master of Agriculture

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FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a paper entitled An Evaluation of Selected Production Concerns in the Alberta Dairy Industry submitted by Michael John Slomp in partial fulfilment of the requirements for the degree of Master of Agriculture.

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Date....August....1982.....

ABSTRACT

There are a number of production concerns which are of particular interest to the Alberta dairy industry. This study introduces, examines and discusses three of these concerns.

The Graduated Entry Program was designed to facilitate entry into the fluid milk market. The benefits of the program are evaluated using net present value analysis. The benefits of the program appear to be relatively limited compared to a "quota purchase" option which appears to be generally more profitable than the Graduated Entry Program option. The question of locational advantage in milk production is examined using some quota value information and cost of production survey results. The examination suggests that there is some discrepancy from these indicators with respect to the optimal location of milk production. The economics of raising replacement heifers and the influence of varying levels of management expertise is also discussed. Significant increases in herd profitability and genetic gain are possible with improved management practices.

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Table of Contents

Chapter Page

ABSTRACT iv

Acknowledgements v

List of Tables viii

I. Introduction 1

II. ADEQUACY OF THE GRADUATED ENTRY PROGRAM 3

A. The Graduated Entry Program 3

B. Analysis Using the Net Present Value Method 5

C. Earned Quota 13

D. Summary 14

III. Locational Advantage in Milk Production 16

A. Quota Values and Sizes of Production Units 16

Economies of Size 18

Summary 19

B. Cost of Production 19

C. Summary 29

IV. Raising Replacement Holstein Heifers 31

A. Calf Management 31

B. Yearling Heifer Management 34

C. A Comparison of Management Levels 36

Analysis 38

Summary 40

D. Loss of Potential Production Income in Alberta 40

E. Summary 43

V. Summary and Conclusions 45
Bibliography 47
Appendix A 49
Appendix B 52

List of Tables

Table		Page
II.1	Net Present Value of the Quota Purchase Option vs.the Graduated Entry Program: An Example	8
II.2	Net Present Values and Breakeven Points for the Quota-Purchase Option vs. the Graduated Entry Option	10
III.1	Cost of Milk Production (according to survey results).	20
III.2	Feed Costs as a Percentage of Total Production Costs (according to survey results).	20
III.3	Feed Costs Per Dollar of Income (according to survey results)	20
III.4	Monetary Value of Feed Fed per Cow (according to survey results)	22
III.5	Total Amount and Monetary Value of Feed Fed per Cow, and the Percentage Difference Between Northern and Southern Alberta (according to survey results)	25
III.6	Quantity of Concentrate and Roughage (according to survey results)	28
IV.1	Effect of Herd Size on Calf Mortality	33
IV.2	Relationship Between Person(s) Caring for Calves and Calf Mortality	33
IV.3	The Effect of Levels of Management on the Number of Replacements Available per Year	37
IV.4	Partial Budget Showing the Advantage of Reducing Age at First Calving from 29.5 to 24 Months.	43

I. Introduction

In recent years, the Alberta dairy industry has been characterized by relative stability. The production of, and revenue from the sale of, milk and milk products is more immune from fluctuations than the production and revenue of most agricultural products, particularly those which do not feature some degree of supply management. With this relative stability it would seem that production concerns would be few in number and superficial in nature. However,there are several production concerns which are of particular interest to the dairy industry. It is the purpose of this study to introduce, examine and discuss these concerns.

The more general production concerns within the Alberta dairy industry include the following: the question of whether the pattern of transportation of raw milk from farm gate to processing plant is efficient; the adequacy of the Graduated Entry Program; the private and social costs of the fluid quota program; locational advantage in milk production; whether there should be greater emphasis on premium pricing of higher quality milk; costs of herd reproductive problems; the economics of raising replacement heifers; and the extent to which current high interest rates act as a barrier to entry of new producers. Each one of these more general concerns warrant individual attention and investigation. Time and other resource constraints, however, permit the examination and discussion of three of these concerns only. The three specific concerns selected are: the

adequacy of the Graduated Entry Program, the locational advantage in milk production, and the economics of raising replacement heifers. These specific concerns were selected primarily due to their contemporary relevance, the availability of pertinent information and the author's personal interest.

The Graduated Entry Program was developed by policy makers to reduce barriers to entry into the fluid milk market. The impact of the program on an individual producer who wishes to commence fluid milk production will be evaluated using net present value calculations. The analysis will evaluate the economic benefits of the program. The question of locational advantage in milk production will be discussed to illustrate the complexities involved in determining an "efficient" locational pattern of milk production. The economics of raising replacement heifers will be examined to illustrate how fine-tuning of certain management practices can improve economic and genetic returns.

Chapter 2 contains the analysis of the Graduated Entry Program, Chapter 3 contains the discussion of locational advantage in milk production, and Chapter 4 contains a study of the economics of raising replacement heifers. A brief summary of each topic follows at the end of the respective chapters. Chapter 5 contains an overall summary and the conclusions and recommendations.

II. ADEQUACY OF THE GRADUATED ENTRY PROGRAM

The fluid milk market features higher prices for milk produced. Though costs are higher, the values associated with the fluid milk quota suggest that profits of producers are also higher in this market. Consequently, the fluid milk market became the most sought after milk markets. However, entry into this more lucrative fluid milk market was very difficult. For example, when expansion of fluid milk markets occurred, the quota increases were usually allotted to the existing fluid milk producers. Industrial milk producers were added to a long waiting list in the hopes of soon being able to obtain fluid milk quota from the plants. These inequities were of concern to both industrial milk producers and policy makers.

A. The Graduated Entry Program

In 1974, in an attempt to reduce the barriers to entry into the fluid milk market, the Alberta Dairy Control Board introduced the Graduated Entry Program (G.E.P). The program would allot three hundred and fifty-two liters of daily fluid milk quota to an industrial milk shipper over a three year period, provided certain conditions were met. The original conditions are presented in Appendix A. Specific changes in the Graduated Entry Program were introduced in 1979:

a. application can be made at any time (originally, applications had to be received prior to September 1 for entry in January 1);

b. dates of entry into the program are on the first of January, May or September;

c. any applicant must now have marketed milk for two months prior to entry date;

d. all applicants must not dispose of either fluid quota or quota previously allotted under the G.E.P. during the 24 month period prior to entry;

e. all applicants are required to ship their graduated entry quota for a full two years before such quota may be transferred other than as set out in other regulations.[1]

One final implicit condition is that, while receiving fluid quota under the G.E.P., the producer is not permitted to purchase any further daily quota until after the total three hundred and fifty-two liters eligible under the program has been allotted. Violation of this condition results in termination of further allotments to the particular producer. The acceptance of new entrants into the G.E.P. has been temporarily suspended since January of this year.

The G.E.P. was designed to facilitate entry of industrial milk producers into the fluid milk market. Under this program one hundred and seventy-six liters were allotted to each successful applicant in the first year, eighty-eight liters in the second year and eighty-eight liters in the third year. At first glance, this program would appear to be a reasonable alternative to purchasing all of the expensive fluid milk quota required. The

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[1]Andres, Gerd, 1980. "Alberta Fluid Milk Quota Policies." Unpublished M.Sc. Thesis, University of Alberta, Edmonton. p.48

discussion will now focus on a comparison of the G.E.P. and the alternative of purchasing fluid milk quota.

B. Analysis Using the Net Present Value Method

The method chosen to compare the two options is to evaluate the net present value of each option. The net present value analysis is one type of the "discounted cash flow" method of measuring investment worth. The net present value analysis involves computing the present value of the net cash inflows and the cash outlays (in this case the capital outlay to purchase quota) of the particular investment. The purpose of this comparison is to determine the most profitable option given variable fluid quota sizes, quota prices and interest rates only. This comparison assumes that the two options have the same facilities and resources available and that the respective goals are also similar. Individual producers will no doubt use a broader range of criteria to evaluate the two options.

There are many different fluid quota sizes attainable and there are also many different costs of fluid quota which may be used. The comparison of the two alternatives makes two basic assumptions: (1) that fluid milk quota is available for purchase; and (2) that necessary financing is available. The assumed values used in calculating the net present values were: the price of fluid milk at 41.58 cents per liter and industrial milk at 31.62 cents per liter. The price for fluid quota was arbitrarily set at $20, $35, $50,

$65 and $80 per liter. The size of fluid quota was also arbitrarily selected at 352 liters, 500 liters, 650 liters, 700 liters, 850 liters, 1,000 liters and 1,250 liters, with the fluid quota sizes of 650 liters, 700 liters and 850 liters being representative of fluid quota size in Alberta.[2]

Table 2.1 shows in detail the calculations involved in comparing the option of buying 700 liters of fluid quota (Alberta average) at $35 per liter (approx. $15 per pound), with the option of the G.E.P.

Table 2.1 serves as an illustration of the calculations involved in comparing the two options. The column entitled "Option One" gives the values for the dollar flow of the "quota purchase" option. The 700 liters are purchased for $35 per liter in "year 0". "Option Two" is the G.E.P. route. The "net dollar flow" column gives the difference of the dollar flow between "option one" and "option two". The "discounted dollar flow" column gives the value of the difference given in the previous column, discounted over time (in this case at 18 percent per year).

In year 1, option one has a dollar flow of $106,237 based on sales of 700 liters daily, at 41.58 cents per liter, for 365 days. Option two (participating in the

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[2]These are rounded off fluid quota size values based on actual fluid quota sizes of 637 liters, 707 liters and 837 liters per day for Northern Alberta, the Alberta average and Southern Alberta, respectively. The actual fluid quota size values were obtained from Table 2 of R. Susko 1982 op.cit. (Total quota milk divided by 365 days equals daily fluid quota production.)

G.E.P.) has a dollar flow of $87,187. Of this amount, $26,711 is obtained from the sale of 176 liters of fluid milk received from the G.E.P.) at 41.58 cents per liter and the remaining $60,476 from the sale of 524 liters (700 liters minus 176 liters) of industrial milk at 31.62 cents per liter. The net dollar flow is $19,050, or $16,144 discounted at 18%.

The same calculations were used for year 2, with the necessary changes made to account for an allotment of an additional 88 liters in option two. Option two also has a capital outlay of $12,180. This investment for option two is the purchase of additional fluid quota to reach 700 liters. In order for net present value comparisons to be meaningful the two options must be made equivalent. For this reason, the options must have equal amounts of fluid quota at the end of three years. The capital outlay is included in year 2 because it is possible without violating regulations to purchase additional fluid quota immediately after the third allotment. Hence, it is assumed that the arrangements for the purchase of additional required quota (700 liters minus 352 liters equals 348 liters, at $35 per liter) will be made prior a respectable month after receiving the third allotment. The discounted dollar flow of option one compared to option two is $20,131.

In year 3 an adjustment must be made to option two to reflect the sale of 352 liters at 41.58 cents per liter and 348 liters at 31.62 cents per liter for 1 month, and 700

Table 2.1: Net Present Value of the Quota Purchase Option vs. the Graduated Entry Program: An Example
(700 liters of fluid milk quota , $35 per liter, i=18%)

		Option One	Option Two	Net Dollar Flow	Discounted Dollar Flow
Year 0	Capital Outlay	-24,500		-24,500	-24,500
Year 1	700 l. x .4158 x 365	106,237			
	176 l. x .4158 x 365		26,711		
	524 l. x .3162 x 365		60,476		
	Net Cash Flow			19,050	16,144
Year 2	700 l. x .4158 x 365	106,237			
	264 l. x .4158 x 365		40,066		
	436 l. x .3162 x 365		50,320		
	Capital Outlay		-12,180		
	Net Cash Flow			28,031	20,131
Year 3	700 l. x .4158 x 365	106,237			
	352 l. x .4158 x 30		4,391		
	348 l. x .3162 x 30		3,301		
	700 l. x .4158 x 335		97,505		
	Net Cash Flow			1,040	633
Total Net Cash Flow				23,621	12,407

Option One: Quota Purchase option
OptionTwo: Graduated Entry Program option

liters at 41.58 cents per liter for 11 months.

After the third year, both options have 700 liters of fluid milk quota. The total net cash flow for the three years for option one compared to option two is $23,621, with a net present value of $12,407.

The calculation procedure presented in Table 2.1 is repeated to arrive at the net present value figures in the inner box of Table 2.2. Net present values figures are given for the fluid quota sizes and prices discussed earlier, with an additional net present value figure for quota at $10 per liter in the 352 liter fluid quota size. Net present values are also given for the $90 per liter cost for the 1,000 liter and 1,250 liter fluid quota size, and for the $100 per liter cost at the 1,250 liter fluid quota size.

The highlighted "staircase line" in Table 2.2 approximates the breakeven points above which it is more profitable to pursue the first option, that is, the "quota purchase" option. For example, a fluid quota size of 700 liters and a quota price of $35 per liter (as presented in Table 1.1) yields a net present value of $12,407, suggesting that option one will, over the period of three years, be $12,407 more profitable than option two. Conversely, it appears that for any value of quota greater than $65 per liter (for a 700 liter fluid quota size), it is less profitable to buy the 700 liters of quota than to receive 352 liters quota gratis and purchase the balance. Option one yields $1,095 less than option two at this quota size and

Table 2.2: Net Present Values* and Breakeven Points for the Quota-Purchase Option vs. the Graduated Entry Option

		Size of Fluid Quota (liters/day)							Breakeven Qouta Sizes at Selected Interest Rates		
		352	500	650	700	850	1000	1250	15%	18%	21%
	10	4,200							258**	261**	264**
	20	680	8,539	16,503	19,159	27,123	35,088	48,363	328**	334**	340**
Cost of	35	-4,600	2,633	9,963	12,407	19,738	27,069	39,287	435	446	459
Quota	50	-9,880	-3,272	3,424	5,656	12,353	19,050	30,211	549	573	601
($/liter)	65	-15,160	-9,178	-3,115	-1,095	4,968	11,030	21,135	682	727	781
	80	-20,440	-15,083	-9,655	-7,846	-2,417	3,011	12,059	838	917	1,015
	90						-2,335	6,008	958	1,070	1,216
	100							-42	1,094	1,252	1,468
Breakeven Qouta Price at Selected Interest Rates	15%	22.68	43.85	61.65	66.92	81.09	93.24	110.02			
	18%	21.93	41.69	57.85	62.57	75.09	85.63	99.93			
	21%	21.23	39.72	54.49	58.74	69.90	79.16	91.52			

* These Net Present Value figures have been calculated with i=18%
** These total fluid quota sizes were calculated with the modification that the amount of fluid quota received from the G.E.P. did not exceed this particular amount for the three years.

value. With quota valued at $90 per liter for a fluid quota size of 1,000 liters, it appears that option one is $2,335 less profitable than option two. When quota costs $90 per liter, a fluid quota size of 1,250 liters yields $6,008 more for option one than option two.

Breakeven quota sizes and quota prices for three rates of interest are also given in Table 2.2. The fluid quota size values in the three right columns indicate the approximate fluid quota size above which option one is more profitable than option two. The fluid quota prices in the bottom three rows indicate the approximate fluid quota price below which option one is more profitable than option two.

With the fluid quota size of 850 liters and an interest rate of 15 percent, the price of quota can increase up to about $81 per liter with option one remaining more profitable. With the same fluid quota size but an interest rate of 18 percent, option one remains more profitable than option two until the price of quota reaches about $75 per liter. And, with an interest rate at 21 percent, option one remains more profitable until the price of quota reaches about $70 per liter. As the interest rate increases, the maximum price of quota at which option one is more profitable than option two, decreases.

With the price of quota at $50 per liter and the interest rate at 15 percent, option one is more profitable than option two for any size of fluid quota greater than 549 liters. For the same price of quota, but at 18 percent

interest, option one is more profitable than option two for any size of fluid quota greater than 573 liters. And, with the interest rate set at 21 percent, option one is more profitable than option two for any size of fluid quota greater than 601 liters. As the interest rate increases, the minimum fluid quota size, above which option one is more profitable than option two increases.

The data in Table 2.2 suggest that given a 650 liter fluid quota size (Northern Alberta average) and assuming a 21 percent interest rate, option one remains more profitable than option two until the price of quota reaches approximately $54 per liter. It is only when the price of quota exceeds $54 per liter at an interest rate of 21 percent G.E.P. appears to be more profitable than the "quota-purchase" option.

When quota is priced at $100 per liter and the interest rate is at 21 percent, option one is more profitable than option two for only those fluid quota sizes which are greater than 1,468 liters. When the price of quota is $35 per liter, option one is more profitable than option two for any size of fluid quota greater than 446 liters at 18 percent interest rate. Conversely, with the price of quota at $35 per liter and the interest rate set at 18 percent, it is only when the fluid quota size is less than 446 liters that the G.E.P. route would be more profitable than the "quota purchase" option. However, at such a low fluid quota size, the economic viability of the production unit is less

certain.

C. Earned Quota

Current dairy policy allots quota gratis to those producers who have produced in excess of their fluid milk quota during the three "low" months of the year. These "low" months are usually the months of September to December, a period when processing plants receive their lowest volume of milk. Producers in the G.E.P. are not eligible to earn quota while they are in the program. They are not eligible until after the final 88 liters have been allotted.

The percentage of additional quota which is allotted to the existing producers, and to the industrial producers via the G.E.P., varies from year to year, depending on the supply levels during the "low" months and the anticipated increase in demand for milk. A producer who has a 1,000 liter daily production level, which includes 100 liters of fluid milk quota, is able to earn quota on the remaining 900 liters sold as industrial milk. Should the allotment of quota to existing fluid producers exceed more than one-half of the total amount of additional alloted quota, this particular producer would receive at least 450 liters of fluid quota gratis. This amount is more than the total allotment available under the G.E.P.

A producer who ships 1,000 liters of milk per day, which includes 352 liters of fluid quota received under the G.E.P., is eligible, after the third year, to earn quota on

the amount of total production which is in excess of 352 liters: in this case 648 liters. On the other hand, a producer who has decided to follow the "quota purchase" option has purchased 1,000 liters of fluid milk quota. This producer has received the fluid milk price for the 1,000 liters of milk for the past three years. However, this producer does not have production in excess of his fluid quota requirement. Hence, the fluid producer, for purposes of this discussion, is not in a position to earn additional fluid quota. The producer who followed the G.E.P. route, is able to earn quota on 648 liters.

These examples have illustrated some of the different possibilities of obtaining quota gratis. There are many further variations and combinations available. Many of the options which concern earned quota possibilities appear to be more profitable than those offered by the G.E.P. However, the amount of quota which is alloted each year is variable. It would be very difficult for a producer to plan on additional quota gratis based on the pattern of allotment in previous years.

D. Summary

It was the intent of the G.E.P. to reduce the barriers to entry into the fluid milk market. The program allotted 352 liters over a three year period to industrial producers who had met certain conditions. Assuming quota size, quota price and interest rates are the only variables, an analysis

of the net present value figures in Table 2.2 suggests that the financial benefits of the program are limited to production units where the fluid quota size is relatively small. It appears that given an average quota price of $35 per liter (a reasonable average for 1981), and an average fluid quota size of 700 liters (the Alberta average for 1981), the "quota purchase" option is more profitable than the G.E.P. option. A limitation of this comparison is that in most situations there are usually more variables to be considered besides the quota size, quota price and the interest rate.

III. Locational Advantage in Milk Production

Economic theory defines efficiency as "the combination of inputs that maximize individual or social objectives."[3] Each producer has a set of goals and objectives and uses his limited resources to meet these objectives. In production economics it is normally assumed that the goal of a producer is profit maximization, which implies economic efficiency.

The purpose of this chapter is to discuss particular locational advantages in milk production. The discussion will focus on quota sizes and costs of production as measures of efficiency in terms of where a locational advantage in milk production might be found.

A. Quota Values and Sizes of Production Units

In discussing the efficient location of milk production in Alberta, Andres (1980) refers to a study in British Columbia which suggests that average total costs decrease as the size of herd is increased to 80 cows. [4] Assuming a milking herd of 60 cows and an average production of about 15 liters (35 pounds) per day, a "reasonably efficient" farm would therefore produce about 881 liters (2,000 pounds) of milk. Using data on the distribution of established fluid milk producers according to the size of daily quota, Andres discusses the implication of dairy farm size levels in Alberta.

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[3] Doll, John P. and Frank Orazem, 1978. Production Economics Theory with Applications. Grid Inc., Columbus, Ohio: p. 47.
[4] Andres, Gerd, 1980. op.cit. p.71-74

With 881 liters of milk daily as a reference point, Andres states that in the Edmonton area, 93 producers produce more than 881 liters daily indicating that 22.5 percent of the producers appear to be operating optimally-sized units. On the other hand, 320 producers were found to produce less than 881 liters suggesting that 77.5 percent of the producers appear to be operating at a less than optimal scale. In the Calgary area, 124 producers (33 percent) were found to be producing at or near the optimal level, while 255 producers (67 percent) were found to be producing at a scale less than optimum. In the Lethbridge area, 30 producers (55 percent) were found to be producing at or near the optimal, while 25 producers (45 percent) were found to be producing at a scale less than optimum.

Andres summarizes by stating that the Lethbridge area has the highest proportion of "reasonably efficient" size fluid milk producers. On the basis that quota values were higher in the Lethbridge area than in the Edmonton milk shed, he concluded that expansion in fluid milk production should be encouraged in the Calgary-Lethbridge area. Proponents of the economies of size concept would suggest that if herd size were not permitted to increase, the efficiency of milk production would decline and the prices for milk and milk products would consequently increase. Skeptics of the idea that "bigger is necessarily better" would suggest that in the absence of some type of protection, the small family farm would not be able to

compete with the large herd farms.

Economies of Size

Seckler and Young[5] discuss why there is an almost universal belief in moderate economies of size in agriculture. They suggest the following scenario: Within a particular region, there is a representative group of farmers, that is, there are those farmers making normal profits; those that are making excess profit (excess in the economic sense); and those that are incurring losses. It is quite conceivable that those farmers who are earning above normal profits will wish to invest further in land to expand their operations, and their total net annual income. These farmers will most likely buy out the farmers that are incurring losses. As these transactions continue, the size of the profitable farms will increase, the number of farms operating at a loss will decrease, and the average size of farm will increase. Seckler and Young state that this process is not absolutely related to economies of size and that it would take place even if the LRAC (Long Run Average Cost) curve was horizontal over all the size ranges.

The logic of the example presented by Seckler and Young can also be used in discussing the economies of size argument with respect to the efficiency of milk production in Alberta. While herd sizes may be increasing, it does not

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[5]Seckler, D. and R.A. Young, 1978. "Economic and Policy Implications of the 160 Acre Limitation in Federal Reclamation Law," American Journal of Agricultural Economics, Vol. 60(4): pp. 575-588.

necessarily follow that significant economies of size exist. It is difficult to say that the larger herds have the most efficient milk production. The managers of the larger herds in southern Alberta have demonstrated their ability to operate the larger sized herd, but further efficiencies as a result of the increased size have not yet been quantified.

Current dairy policy prevents the transfer of fluid milk quota from one milk processing plant to another, except with special authorization from the Alberta Dairy Control Board. These constraints on the transfer of quota appear to impede the attainment of further possible economies of size.

Summary

If the larger herds are currently achieving economies of size, further increases in herd size and possibly economies of size are unlikely, unless the smaller herds shipping to the same plant are purchased outright by the larger herds. The non-transferability of fluid quota restrains the large herd operator from attaining further possible economies of size.

B. Cost of Production

Efficiency of milk production in Alberta can be assessed using cost of production information from surveys conducted by Alberta Agriculture. [6] The data in Table 3.1

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[6]The Production Economics Branch of the Economic Services Division, Alberta Agriculture has been conducting cost of production surveys since the Second World War. Approximately 60 dairy producers throughout the province participate in these cost studies on a more or less voluntary basis.

Table 3.1: Cost of Milk Production (according to survey results).
(Dollars per hectoliter)

	1977	1978	1979	1980	1981
Northern Alberta	28.44	28.92	34.82	38.20	38.69
Southern Alberta	27.85	30.96	36.27	41.38	41.33
Difference (South - North)	-.41	2.04	1.45	3.18	2.64

Source: Susko,R. "Economics of Milk Production in Alberta" Production Economics Branch, Economic Services Division, Alberta Agriculture, Edmonton. Vol 37-41, 1977-1981.

Table 3.2: Feed Costs as a Percentage of Total Production Costs (according to survey results).

	1977	1978	1979	1980	1981
Northern Alberta	35.4 ($10.07*)	35.4 ($10.24)	32.4 ($11.28)	33.2 ($12.67)	38.4 ($14.87)
Southern Alberta	39.3 ($10.94*)	39.0 ($12.07)	35.8 ($12.97)	38.5 ($15.95)	42.1 ($17.38)

(actual feed costs/hl. of milk sold are given in brackets)
*These feed costs/hl. of milk sold were calculated from feed costs/cwt.of milk produced.
Source: Compiled from Susko,R."Economics of Milk Production in Alberta"

Table 3.3: Feed Costs Per Dollar of Income (according to survey results).

	1977	1978	1979	1980	1981
Northern Alberta	.35	.33	.32	.32	.33
Southern Alberta	.37	.38	.36	.40	.37

Source: Susko,R. "Economics of Milk Production in Alberta"

suggest that the cost of production of fluid milk has been lower in northern Alberta (considered to be that area of the province north of Red Deer) than southern Alberta (that area of the province south of and including Red Deer) for the years 1978 to 1981. For the last four years, the northern Alberta production costs have ranged from $1.45 to $3.18 per hectoliter lower than the southern Alberta production costs. Further discussion of the differences in production costs requires a closer examination of the component parts of the production costs.

One of the major expenditure items in milk production is feed costs. Table 3.2 lists the feed costs as a percentage of the total production costs.[7] It appears that feed costs are a higher percentage of the total production costs in southern Alberta. The feed costs as a percentage of total production costs ranged from 3.4 to 5.3 percent higher for southern Alberta. The data in Table 3.3 appear to confirm the higher feed costs in southern Alberta. The feed costs per dollar of income ranged from 2 to 8 cents higher in southern Alberta.

The data in Tables 3.2 and 3.3 are based on total feed fed figures, with no adjustments made to account for the varying intensities of feed use. It is possible that a higher level of usage of either the concentrates or

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[7]The feed costs obtained from R. Susko are calculated as follows: Whether the feed is homegrown or purchased, the dairy enterprise is charged the current market price for the particular feed.

Table 3.4: Monetary Value of Feed Fed per Cow(according to survey results).

	1977		1978		1979		1980		1981	
	North	South	North	South	North	South	North	South	North	South
Grain	169.68	70.75	130.23	60.96	117.20	90.38	187.94	135.07	187.85	179.59
Dairy Ration	36.87	250.97	34.17	230.59	118.03	167.95	137.86	208.06	209.29	248.99
Supplement	26.06	9.70	22.91	8.70	14.96	82.79	16.23	59.93	14.59	46.72
S,M,V*	10.21	6.25	8.69	7.41	7.82	8.73	9.86	6.91	9.73	12.19
Roughage	249.50	268.37	262.42	324.65	265.77	355.63	297.54	450.39	346.39	436.88
Pasture	24.65	19.49	34.49	18.39	33.49	12.55	29.54	20.41	29.85	21.29
Processing	7.76	0.96	9.69	5.46	7.84	3.05	3.89	7.60	2.71	9.19
Total	524.73	626.49	502.61	656.15	565.11	721.07	682.85	888.37	800.41	954.84

North:Northern Alberta; South:Southern ALberta
*S,M,V:salt,minerals,vitamins

Source: Susko,R. "Economics of Milk Production in Alberta"

roughages would, by itself, explain the difference in feed costs between northern and southern Alberta. The data in Table 3.4 indicate the monetary value of the feed fed per cow in the northern and southern regions, for the years 1977-1981. The monetary value of the dairy ration and roughage fed per cow in southern Alberta was consistently higher than the corresponding value for northern Alberta. The total monetary value of the feed fed in southern Alberta exceeds that of northern Alberta for the years 1977-1981.

Table 3.5 contains the aggregated data for the total monetary value of concentrates fed per cow (including grain, dairy ration, supplements, salt, minerals, vitamins and processing costs) and the total monetary value of roughages fed per cow (including pasture). Table 3.5 also contains the total amounts of concentrate fed per cow (tonnes) and roughage fed per cow (tonnes). Using the monetary value of the feed fed per cow and the actual amount of feed fed per cow, it is possible to analyze the increases in one compared to the other. The percent values in Table 3.5 indicate the difference between northern and southern Alberta feed amounts and feed values. For example, in 1977, while the average amount of concentrate consumed was 11 percent higher in southern Alberta than northern Alberta, the monetary value of the consumed concentrate was about 35 percent higher in southern Alberta than in northern Alberta. It would appear that with concentrate usage only 11 percent higher in southern Alberta and with the monetary value of

the concentrate 35 percent higher in southern Alberta, the remaining 25 percent of the higher monetary value is associated with higher concentrate costs in southern Alberta. The amount of roughage consumed in southern Alberta was similar to the amount consumed in northern Alberta (0.5 percent difference). The difference in the monetary value between the roughage fed in southern Alberta compared to northern Alberta was 5 percent. It would appear that the 4.5 percent higher monetary value of consumed roughage in southern Alberta is associated with higher roughage costs in southern Alberta. The last two rows of Table 3.5 contain the figures for the total amount and monetary value of the feed fed per cow.

The data for the years 1978 to 1981 reveal a pattern nearly identical to that of 1977. In every year except one, the monetary value of the feed consumed in southern Alberta was noticeably higher than the feed consumed in northern Alberta, even taking the higher level of feeding in southern Alberta into account. It appears that the concentrate price differential between northern and southern Alberta decreased somewhat during the time period studied, while the roughage price differential increased somewhat over the same time period.

A longer growing season, a more favorable climate, and the the use of irrigation in southern Alberta contribute to the production of higher quality feeds compared to northern Alberta. The higher cost of feed in southern Alberta

Table 3.5: Total Amount and Monetary Value of Feed Fed per Cow,and The Percentage Difference Between Northern and Southern Alberta(according to survey results).

	1977			1978			1979			1980			1981		
	North	South	% Diff.	North	South	% Diff.	North	South	% Diff.	North	South	% Diff.	North	South	% Diff.
Conc. Value*	250.58	338.63	35.1	205.69	313.12	52.2	265.85	352.90	32.7	355.78	417.57	17.4	424.17	496.68	17.1
Conc./Cow**	2.87	3.18	10.8	2.59	3.04	17.4	2.37	2.88	21.5	2.61	2.71	3.8	2.80	2.92	4.3
Rough. Value	274.15	287.86	5.0	296.91	343.04	15.5	299.26	368.18	23.0	327.08	470.80	43.9	376.24	458.17	21.8
Rough./Cow**	5.81	5.84	0.5	5.76	6.55	13.7	4.96	6.14	23.8	5.00	5.43	8.6	5.44	5.44	0.00
Feed Value	524.73	626.49	19.4	502.61	656.15	30.5	565.11	721.07	27.6	682.85	888.37	30.1	800.41	954.84	19.3
Feed/Cow**	8.68	9.02	3.9	8.35	9.59	14.9	7.33	9.02	23.1	7.61	8.14	6.9	8.24	8.36	1.5

Percentages calculated by author.
North: Northern Alberta
South: Southern Alberta
Conc.: Concentrate
Rough.: Roughage
*Total Concentrate Value(includes processing costs)
**Amount of feed per cow is given in tonnes

Source: Compiled from R. Susko "Economics of Milk Production in Alberta"

reflects, to some extent, the higher quality of the feed.

The apparently higher costs for feed in southern Alberta may, to some extent, be explained by higher costs of crop production in the irrigated areas of southern Alberta. For example, the potentially higher productivity associated with irrigated land frequently results in increased land prices. Coupled with increased land prices are higher costs of crop production, particularly those involved in investment in irrigation equipment. As a consequence, crops with a potential for higher return are grown. Although the "standard" grain and roughage crops are grown in the irrigated area, the higher overhead costs discussed earlier are included in the costs of producing these crops, with the result that the imputed prices of these crops exceeds that for northern Alberta. [8]

Another option which is available to the producers in the irrigated districts of southern Alberta is to purchase cheaper feed from areas where the "standard" crop production is more economical. An increased cost would be the transportation costs involved.

A further related possible reason for the higher feed costs indicated for southern Alberta is that the opportunity costs of "standard" crop production are higher in the irrigated districts of southern Alberta than in northern Alberta. The principal difference between northern and

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[8] "Standard" grain and roughage crops refers to crops such as barley, oats and alfalfa which are used in the dairy enterprise.

southern Alberta production alternatives is that there are more profitable production alternatives in the irrigation district of southern Alberta. The opportunity is available for the producers in the irrigated districts to grow "specialty" crops which yield a higher return. Hence, "standard" crops which are grown involve higher opportunity costs. It would appear that opportunity costs are a very probable reason for the higher feed costs in southern Alberta.

An examination of the data in Table 3.6, which indicates, from the survey data the amounts of homegrown feed fed compared with purchased feed fed in northern and southern Alberta, reveals that home-grown grains and roughages are deficit in southern Alberta. The data appear to suggest that the northern Alberta producers have consistently fed more homegrown concentrates and roughages than purchased concentrates and roughages compared to southern Alberta producers. The percentage of the total concentrate fed which was grown on the farm ranged from 61.2 percent in 1977 to 57.7 percent in 1981. The percentage of the total roughage fed which was grown on the farm ranged from 87.0 percent in 1977 to 75.4 percent in 1981.

The southern Alberta producers have consistently fed more purchased concentrates than homegrown concentrates and they have fed more homegrown roughage than purchased roughage. The percent of homegrown roughage fed in southern Alberta is less than the percent of homegrown roughage fed

Table 3.6: Quantity of Concentrate and Roughage(according to survey results).
(Purchased and Homegrown, in tonnes)

Concentrate

Year	North					South				
	Total Amount	Purchased Amount	Purchased %	Homegrown Amount	Homegrown %	Total Amount	Puchased Amount	Purchased %	Homegrown Amount	Homegrown %
1977*	142.26	54.30	38.2	87.96	61.2	228.30	185.90	81.4	42.40	18.6
1978*	122.39	48.79	39.8	73.60	60.2	203.31	148.26	72.9	55.05	27.1
1979	116.14	51.54	44.4	64.60	55.6	192.73	136.33	70.7	56.40	29.3
1980	133.61	48.28	36.1	85.33	63.9	184.24	125.09	67.9	59.15	32.1
1981	147.67	62.41	42.3	85.26	57.7	193.66	130.15	67.2	63.51	32.8

Roughage

Year	North					South				
	Total Amount	Purchased Amount	Purchased %	Homegrown Amount	Homegrown %	Total Amount	Purchased Amount	Purchased %	Homegrown Amount	Homegrown %
1977*	287.89	37.47	13.0	250.42	87.0	419.73	73.82	17.6	345.91	82.4
1978*	272.00	36.12	13.3	235.88	86.7	438.13	75.66	17.3	362.47	82.7
1979	243.24	47.16	19.4	196.08	80.6	411.37	106.35	25.8	305.02	74.2
1980	255.48	27.94	10.9	227.54	89.1	369.89	141.00	38.1	228.89	61.9
1981	287.02	70.84	24.6	216.18	75.4	361.57	147.48	40.8	214.09	59.2

*Amounts for 1977 and 1978 are given in tons
Source: Compiled from Susko, R. "Economics of Milk Production in Alberta"

in northern Alberta. The percentage of the total concentrate fed which was grown on the farm, ranged from 18.6 percent in 1977 to 32.8 percent in 1981, while the percentage of the total roughage fed which was grown on the farm ranged from 82.4 percent in 1977 to 59.2 percent in 1981.

For the purpose of this discussion the important pattern which emerges from the data is that the northern Alberta producers feed more homegrown concentrates and roughages (on a percent basis) than do the southern Alberta producers. This pattern is consistent with the suggestion that opportunity costs of growing feed are relatively higher in the south, resulting in a lower level of homegrown feeds being fed. The southern Alberta producers may be growing higher value crops on their farms, instead of the standard alfalfa and grain crops, and purchasing the required feed. The cost-of-production data which are available do take the higher opportunity costs of crop production in the irrigated areas of southern Alberta into account in the form of higher imputed feed prices.

C. Summary

The previous discussion on the issues of regional differences in quota values, economies of size, and costs of production implies that the question of locational advantage in milk production is a complicated one. Producers and policymakers alike are interested in the question of locational advantage in milk production. But the search for

answers is dampened by a lack of data. Although the benefits of locational advantage as determined by quota values were thought to be present in southern Alberta, available data are not uncompromisingly in support of this belief. The published cost of production results in particular, suggest the opposite of the quota value data. Published cost of production results indicate lower production costs in northern Alberta.

The question of optimal location of milk production is not easily answered. There are not enough data or measurements available to permit a simple once-and-for-all solution. Further examination of the interrelationships of various economic factors is required to provide answers which may assist producers and policymakers with the question of locational advantage in milk production.

IV. Raising Replacement Holstein Heifers

The productive life of dairy cows in North America is short compared to the productive life of dairy cows in Europe and Australia and New Zealand. North American cows are culled from the herd at a relatively young age and some possible reasons for this heavier culling rate include reproductive, breeding and nutritional problems. The heavy culling rate means that a high number of replacements are required to maintain herd size. A study examining the causes of the short productive life of dairy cows in North America would be beneficial but is beyond the scope of this paper.

It is the intent of this chapter to discuss the factors, other than culling rate, which determine the number of replacements available and their age at first calving. The genetic and economic consequences will be evaluated to assess the cost of particular management practices. A number of comparisons will be made to illustrate how calf and heifer losses together with older calving ages affect the profitability and genetic improvement of a herd.

A. Calf Management

One of the most important determinants of the total number of replacements available is the number of calves which survive the first six months of their life. It is suggested that more than 90 percent of all calf and heifer mortality occurs within the first six months of life and

over one-half of these occur within the first week.[9]

An examination of the data in Tables 4.1 and 4.2 reveals that herd size and the person caring for the calves are important determinants of calf mortality. Table 4.1 indicates a range in total calf mortality from 13.3 to 33.4 percent depending on herd size. It appears that calf neglect may increase with size of herd. Table 4.2 indicates a range in annual calf mortality from 12.3 to 20.1 percent depending on the person responsible for providing calf care. It appears that mothers and wives are most successful in raising young calves. It is possible that there is a direct relationship between the size of the herd and the person responsible for providing calf care.

Other factors which appear to be associated with a higher calf mortality include the following [10]: (1)degree of calving difficulty, (2)herd production level (the survival rate increases with production level), (3)type of liquid feeding program (the survival rate of calves increases when whole milk rather than milk replacer is fed), (4)breed of cattle (in order of decreasing survival rate: Ayrshires, Brown Swiss and Holsteins, Jerseys and Guernseys)and (5)season of birth (there are higher survival rates for calves born in summer compared to winter).

The discussion thus far has served to illustrate that many factors affect the survival rate of young calves. It is

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[9]Etgen, William M.and Paul M. Reaves 1978 Dairy Cattle Feeding and Management John Wiley and Sons, New York. p.332

[10]Ibid. p.332

Table 4.1:Effect of Herd Size on Calf Mortality

No. of herds	Herd size	Died before 3 mo.(%)	Born dead or abnormal(%)	Total mortality(%)
76	40-50	7.4	6.8	13.3
94	51-75	8.7	7.4	16.1
37	76-100	9.6	8.5	18.1
23	101-125	9.7	8.0	17.7
14	126-200	14.2	6.8	21.0
3	200-350	21.3	12.1	33.4

Source: Hartman, D.A. et al 1974 "Calf Mortality" J. of Dairy Sci.57: p.577

Table 4.2:Relationship Between Person(s) Caring for Calves and Calf Mortality

Person providing care	Farms	Calf Mortality(%)		
		Winter	Summer	Annual
Operator	171	16.2	10.0	12.8
Operator and others	158	16.5	10.6	13.3
Hired labor	25	28.1	12.4	20.1
Mother or wife	25	15.0	9.4	12.3

Source: Appleman, R.D. and F.G. Owen 1975."Breeding, Housing, and Feeding Management". J. of Dairy Sci.58: p.448

reasonable to suggest that a conscientious effort to reduce calfhood mortality will contribute significantly to the goal of increasing the number of available replacements.

B. Yearling Heifer Management

Another management practice which will increase the total number of replacements available is the reduction of the age at first calving. A reduction in the age at first calving also permits the producer to benefit from potential genetic improvement and milk sales sooner than usual.

When the decision is made to attempt to reduce the age at first calving, action must begin with the newborn calf. To calve at 24 months of age , a heifer must be bred at 15 months of age. Given this time frame as a practical objective, the growth of the heifer must be such that the heifer will reach puberty by 14 months and be bred by 15 months. Swanson discusses several research reports which suggest that the appearance of puberty is directly and positively related to rate of growth and is dependent on size rather than age.[11] Holstein heifers should gain .6 to .7 kg. per day to achieve the goal of breeding at 14 to 15 months. [12]

Growth rate extremes are undesirable. Underfeeding of heifers results in a delay in the onset of puberty and hence a delay in the time of breeding. Of utmost concern to

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[11]Swanson, E.W. 1967 "Optimal Growth Patterns for Dairy Cattle" J. Dairy Sci. 50: p.244-252
[12]Etgen and Reaves, op. cit. p.334

producers is that underfed and consequently undersized heifers usually experience more calving difficulties. The probability of calving difficulties(and hence dead calves) increases when heifers are undersized. For this reason alone producers should be certain that heifers are growing adequately to be of sufficient size at calving. Moderate restriction of good quality feed should ensure a reasonable rate of growth for heifers. Heifers that are slightly underfed up to calving will be smaller in size and will tend to produce somewhat less for the first lactation but will recover rapidly in both size and milk production if they are well fed after calving.[13] [14]

Overfeeding of heifers results in breeding delays, calving difficulties and reduced lactation production. In a number of experiments, overfed (fat) heifers production was below normal in the first and second lactations. A possible explanation is that there was abnormal mammary development in the fat heifers.[15]

When heifers are raised such that they will be bred at 15 months and hence calve at 24 months, the overall costs of raising replacements will be reduced. The earlier calving helps to reduce the overhead costs per milking cow.

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[13]Schultz, L.H. 1969 "Relationship of Rearing Rate of Dairy Heifers to Mature Performance" J. Dairy Science 52: p.1312-1329

[14]Swanson, E.W. 1978 "Heifer Performance Standards: Relation of Rearing Systems to Lactation" in Large Dairy Herd Management ed. C.J. Wilcox and H.H. Van Horn. A University of Florida Book, University Presses of Florida,Gainesville. p.500-501

[15]Ibid. p.501

C. A Comparison of Management Levels

A reduction in calfhood mortality and a decrease in the age at first calving are very important steps on the road to increasing the total number of replacements available. The following examples compare three different levels of management. [16]

Table 4.3 illustrates the effect of three different levels of management on the replacements available each year. The calculations are based on an average Alberta herd size of 76.5 cows and an average Alberta replacement(culling) rate of 20 percent.[17] A replacement rate of 20 percent means 15 replacements are required per year for an average herd size of 76.5 cows. The calculations are also based on an abortion and stillbirth loss of 10.6 percent, a sex percentage of 46.8 percent female, and a sterility and death rate of 9 percent. [18] The "average age" of cows is used in the calculations because the "disposal age" of the cows is not available.

The different levels of management considered here involve assumptions regarding 4 variables which, when used with the basic data discussed earlier, lead to the widely varying surplus(deficit) values reported in Table 4.3. The

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[16]The high and low management levels were arbitrarily selected to illustrate the effect of various management levels.

[17]Unless otherwise stated, all 'Alberta average' figures have been obtained from A.A. Hughes, Dairy Cattle Improvement Branch, Dairy Division, Wetaskiwin

[18]Since no Alberta figures are available, these values are taken from Evans, D.L. 1977 "You need all your heifers for replacements" Hoard's Dairyman 122(16): p.963

Table 4.3: The Effect of Levels of Management on the Number of Replacements Available per Year.

Level of management	High[9]	Alberta Average[10]	Low[11]
Calves per cow[1]	4.4	3.4	2.5
Total calves born alive[2]	301	232	171
Total heifers born alive[3]	141	109	80
Total heifers at breeding age[4]	130	92	61
Total replacements[5]	118	84	55
Replacements per year[6]	22	17	12
Rep. Required per year[7]	14	15	16
Surplus(deficit)[8]	8	2	(4)

[1] Calves per cow=(average age of cows)-(age at first calving)divided by(calving interval)+(first calf)
[2] Total calves born alive=(calves per cow)x(average herd size: 76.5 cows) with an adjustment for abortion + stillbirth loss: 10.6%
[3] Total heifers born alive=(total calves born alive)x(sex percentage: 46.8% female)
[4] Total heifers at breeding age=total heifers born alive with an adjustment for calfhood mortality
[5] Total replacements=total heifers at breeding age with an adjustment for sterility and death rate: 9%
[6] Replacements per year=(total replacements)x(replacement rate: 20%)
[7] Replacements required per year=(herd size: 76.5 cows) x (culling rate: 18.5%, 20%, and 21% for high, Alta. average, and low levels of management, respectively; based on productive life of cow)
[8] Surplus(deficit)=(replacements per year)-(minimum replacements required per herd)
[9] High: average age=65 mo.; av. age at first calving=24 mo.; calving interval(C.I.)=12 mo.; calfhood mortality=8%
[10] Alberta average: av age=60.75 mo.; av. age at first calving=29.5 mo.; C.I.=13 mo.; calfhood mortality=16%
[11] Low: av. age=57 mo.; av. at age first calving=36 mo.; C.I.=14 mo.; calfhood mortality=24%

high level of management has the following characteristics: the average age of the cows in the herd is 65 months (a higher average age of cows in the herd indicates that the cows in the herd have a longer productive life); the average age at first calving is 24 months; the calving interval is 12 months (a shorter calving interval indicates fewer delayed breeding problems); the calfhood mortality rate is 8 percent. The Alberta average level of management uses average Alberta values for the variables: the average age of the cows in the average Alberta herd is 60.75 months; the average age at first calving is 29.5 months; the calving interval is 13 months; and the calfhood mortality is 16 percent.[19] The low level of management has the following characteristics: average age of cows in the herd is 57 months (a younger average age indicates cows leaving the herd sooner); average age at first calving is 36 months; the calving interval is 14 months; and the calfhood mortality is 24 percent.

Analysis

The high level of management yielded a total of 22 replacements per year, with the Alberta average and the low level of management yielding 17 and 12 replacements respectively. The large number of replacements available in the high level of management example provides the manager with the opportunity to apply more selection pressure. Such

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[19] Since no Alberta figures are available this value is taken from ibid. p.963

greater selection pressure, which usually means higher selection criteria, could lead to better production averages. The manager is in a position to be able to select the replacements in much the same manner as the herd is culled.

The Alberta average example provides only 2 replacements more than is required for herd maintenance. Although some selection pressure can be applied, the selection criteria will not be as high as under the high level of management example. The manager has less of an opportunity to select heifers compared to the high level of management example.

The low level of management example is seriously short of meeting the basic herd replacement requirements. With only 12 replacements, the manager has lost the opportunity to apply selection pressure to the replacement herd and still meet the minimum replacement requirements. With the low level of management, the manager loses the opportunity to cull the milking herd on the basis of production. Four additional animals must be purchased to maintain herd size.

The economic consequences of the three levels of management are significant. The high level of management example has the opportunity to sell 8 replacements for a value of at least $8,000. [20] The average Alberta manager is able to sell 2 replacements valued at $2,000. The low level

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[20]Based on a conservative estimate of $1,000 per replacement.

of management example must purchase 4 replacements valued at $4,000 to maintain herd size. There appears to be a $12,000 difference in revenue, based on the replacement herd alone, between the high and low level of management. The improved productive life of the average cow, age at first calving, calving interval and calfhood mortality rate has provided the high level of management manager the opportunity to increase selection pressure and receive additional revenue from the sale of replacements.

Summary

These examples have served to illustrate the consequences of three different levels of management. There are substantial economic and "genetic improvement" losses in the low level of management example. The high management example illustrates benefits from the opportunity to apply more selection pressure and receive additional income from the sale of replacements. None of the characteristics of the high management example should be considered out of reach of the better dairyman of today.

D. Loss of Potential Production Income in Alberta

An examination of Dairy Herd Imrovement (D.H.I.) data reveals that the average age at first calving is approximately 29.5 months, with a range from 20.1 to 41.8

months.[21] It is generally accepted that 24 months is a reasonable age for first calving. The Alberta average is about 5.5 months away from that goal.

The most recent estimated costs for raising Holstein replacement heifers are found in Appendix B. In 1980, the total cost of raising a heifer to 29.5 months was $955.67. This includes $82.00 for the period of 24 to 27 months and $75.14 for the period of 27 to 29.5 months. To update these costs to 1981, a 5 percent increment was added to the 1980 estimated costs. The total estimated cost of raising a heifer to 29.5 months in 1981 was $1,003.45, including $86.10 for the 24 to 27 month period and $78.90 for the 27 to 29.5 month period.

It is now possible to calculate the anticipated benefits of a younger age at first calving. An 'average' heifer, which calves on January 1 of a given year, has a Breed Class Average (B.C.A.) of about 120. At this B.C.A. level the heifer is expected to produce about 15.4 liters (35 pounds) per day. Table 4.4 uses a partial budget to show the advantage of reducing age at first calving.

The distance from the actual age of first calving to the desired age at first calving is about 5.5 months or 167 days. To calculate the advantage of the earlier calving, the

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[21]Special Management Report, Dairy Cattle Improvement Branch, Dairy Division, Wetaskiwin. (1978-1982)The average age of first calving in January of 1978, 1979, 1980, 1981, and 1982 was 30, 29.6, 29.8, 29.6, 29.2 months, respectively. The average age at first calving of 29.5 months was chosen for ease of calculation.

number of days of milk production (167) is multiplied by the expected daily production (15.4 liters), and this total, which is the additional amount of milk, is multiplied by the price of milk ($41.58 per hectoliter). The additional income appears to be $1,069.35.

The additional cost associated with the earlier calving is the milking cow cost per day of $5.26;[22] A reduced cost is the heifer cost per day: $0.99; [23]

The net advantage of reducing age at first calving from 29.5 to 24 months is $356.26. This is the expected benefit, per replacement heifer, of the reduction of the age of first calving. To determine the benefit per herd, the benefit per heifer is multiplied by the number of replacements per herd. With a replacement rate of about 20 percent and an average size of herd of 76.5 the number of replacements per herd is 15. Hence, the economic benefit of a reduced age of first calving is about $5,344 per Alberta D.H.I. herd.

The benefit of reducing the age of first calving appears to be substantial. With the actual age at first calving at 29.5 months, the loss of potential production income appears to be about $5,344 per herd. Alberta has apprximately 46,000 cows in the D.H.I. program. A 20 percent

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[22]Calculated from Susko, R. 1982. op. cit. Table 2 The production cost per cow, minus the inventory adjustment value, and divided by 365 days, yields the 'milking cow' cost per day.

[23]The estimated total cost of raising a heifer from 24 to 29.5 months, in 1981, is $86.10 + $78.90 or $165.00. Therefore, $165.00 divided by the 167 days that the heifer is milking = $0.99 per day.

Table 4.4: Partial Budget Showing the Advantage of Reducing Age at First Calving From 29.5 to 24 mos.

Added Costs $5.26 x 167 days	$878.42	Added Revenue 15.4 l. x .4158 x 167	$1,069.35
Reduced Revenue	0	Reduced Costs .99 x 167	$165.33
Total Disadvantages	$878.42	Total Advantage	$1234.68
		Net Advantage	$356.26

replacement rate suggests that 8,740 replacement heifers are required to maintain present herds. Provided everything else remains the same, the loss of potential production income appears to be about $3.1 million for the Alberta D.H.I. herds alone.

E. Summary

There are many factors which determine the number of replacements that are available to a herd manager. Calf mortality and age of calving appear to have important consequences for the number of replacements available. Different management levels provide varying numbers of replacements, affecting genetic gain and the income of the particular herd. Average age at first calving can be reduced

to 24 months from the current Alberta average of 29.5 months without affecting first lactation production. The loss of potential production income from delayed first calving alone exceeds $4,900 per herd on D.H.I. It appears that with some fine-tuning of certain management practices, producers may be able to obtain both genetic and economic benefits.

V. Summary and Conclusions

This study examined three selected production concerns. The Graduated Entry Program was analyzed in Chapter 2 using net present value calculations. Locational advantage in milk production was discussed in Chapter 3. The economics of raising replacement heifers was evaluated in Chapter 4.

The Graduated Entry Program was developed to reduce barriers to entry into the fluid milk market. It was found that under certain conditions the benefits of the program to an individual producer appear rather limited. For example, using net present value analysis and given an average quota price of $35 per liter and an average fluid quota size of 700 liters, the Graduated Entry Program would be less profitable for an individual producer than the "quota purchase" option.

There are several methods of determining locational advantage in milk production. In this study, the indications given by quota value, are contrasted with cost of production data. There are higher opportunity costs associated with higher prices of feed in southern Alberta. This comparison reveals an apparent contradiction as to areas of the province which appear to have a locational advantage in milk production. However, this might be solved by further study applying the principles of regional comparative advantage rather than those of absolute advantage which are implied by the absolute cost comparisons.

The genetic gain and the profitability of a herd is affected to a large extent by certain management practices. Examples are given to illustrate the particular benefits of improved management practices. Calfhood mortality and age at first calving appear to be significant determinants of the total number of replacements available. Approximately $5,300 of potential production income is lost in Alberta Dairy Herd Improvement herds due to delayed first calving alone.

This study has attempted to illustrate the economic aspect of several selected production concerns. It is hoped that this presentation of the economics of particular management practices will reveal some of the costs involved. An examination of economic factors in the more macro level question of locational advantage in milk production and in the more micro level question of raising replacement heifers will assist in a more comprehensive understanding of these issues which face the Alberta dairy industry.

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Appendix A

GOVERNMENT OF THE PROVINCE OF ALBERTA

ALBERTA REGULATION 334/74

(Filed December 18, 1974)

THE DAIRY BOARD ACT
(O.C. 2046/74)

Quotas

13. The Dairy Board shall determine the needs of processors and shall allot daily quotas to licensed producers supplying milk to processors.

14. A daily milk quota allotted to a licensed producer by the Dairy Board shall remain in effect until it is suspended or revoked or changed in accordance with these regulations.

15. (1) In January of each year the Dairy Board shall make any necessary adjustments in the daily quota allotted to each producer based on the average daily processor's milk sales during the preceding calendar year and shall allot the quota to any additional producers where necessary to meet the processor's sales requirements.

(2) Notwithstanding subsection (1), where the Dairy Board considers it necessary to do so, it may make adjustments in quota at any time.

16. In January of each year the Dairy Board may reduce the quota of any licenced producer who has failed to deliver the full amount of his quota, calculated on a daily basis, during the quota period.

17. The quota made available as the result of the reduction of a producer's quota shall be allotted by the Dairy Board to licensed producers or to new producers in such proportions as the Dairy Board may determine.

18. The quota of a producer may be increased by the Dairy Board where that producer ships more than his daily quota during the quota period.

19. The Dairy Board shall not adjust the quota of any licensed producer where all or part of the milk delivered by him to a processor is classified as being off-flavour.

20. No producer shall transfer quota unless

(a) at least two years have expired from the date that the quota was allotted, and

(b) the Dairy Board approves the transfer.

21. A person who transfers all or part of his quota shall not receive any further allotment from the Dairy Board until the second annual quota adjustment following that transfer.

22. (1) An application for the transfer of quota shall be submitted to the Dairy Board at least 14 days prior to the proposed transfer date.

(2) A transfer of quota must be effective on the first day of a month.

23. (1) Each producer shall deliver his quota every month to the processor to whom he is assigned.

(2) Except where milk is picked up every other day the producer's deliveries shall be twice his daily quota.

(3) The period between two deliveries of milk from a producer shall not exceed two days.

24. (1) A processor shall accept all milk delivered in accordance with these regulations by the producers assigned to him.

(2) The Dairy Board may transfer a licensed producer to such processor as it may designate.

Graduated Entry

25. A person who

(a) is a resident of Alberta,

(b) has marketed milk or cream to an Alberta plant for the 12 consecutive months prior to September 1 of the year of application,

(c) has marketed a daily average of at least 500 pounds of milk or the cream equivalent thereof for those 12 months,

(d) submits an application prior to September 1 for entry on January 1 of the following year,

(e) has farm premises which meet the requirements for Alberta fluid milk production and are approved pursuant to regulations under The Dairymen's Act prior to December 1 of the year of application or in the case of a cream producer who is converting to milk, such later date as the Dairy Board may determine,

(f) has installed a bulk tank of sufficient capacity to store at least five milkings, and

(g) has a milk production quality record both past and present which meets the requirements of regulations under The Dairymen's Act and Division 9 of The Provincial Board of Health Regulations under The Public Health Act,

may over a three-year period be allotted a daily milk quota by the Dairy Board in accordance with section 26.

26. (1) The Dairy Board shall in accordance with this section compute the quota to be allotted to an applicant (graduated entrant) under section 25.

(2) The entrant shall receive a total quota equivalent to his basic daily production up to a maximum of 800 pounds per day.

(3) The entrant shall receive 50 per cent of his quota on January 1 of the year of entry and an additional 25 per cent on January 1 of each of the next following two years.

(4) Where more applicants than are required qualify the Dairy Board may conduct a draw and allot quota in accordance with the results.

(5) Where an applicant qualifies but no quota is available, his application shall have priority in succeeding years.

(6) The entrant must maintain his daily basic production during the period of graduated entry and where this declines, his allotted total quota shall be reduced by a proportionate amount.

27. (1) Upon completion of graduated entry, the entrant shall in subsequent years be eligible for a quota increase based on production on the same basis as other fluid milk quota holders.

(2) The entrant or successful applicant may not transfer his right to graduated entry or his remaining entitlement except to a person who is a member of his immediate family or to a person who is purchasing his farm, buildings and herd as a going concern.

(Extract from *The Alberta Gazette*, December 31, 1974)

Appendix B

ESTIMATED COSTS TO RAISE HOLSTEIN DAIRY HEIFERS - ALBERTA 1980*

	Per Heifer	
0-2 MONTHS, WEIGHT 90 (BIRTH) TO 150 POUNDS:		
Milk Substitute: except first 3 days, 45 lbs. @ 48¢ per lb.	$ 21.60	
Calf Concentrate: 10 lbs. first month & 70 lbs. second month = 80 lbs. total @ $10.50/cwt	$ 8.40	
Alfalfa Hay: 75 lbs. @ $55 per ton	$ 2.06	
TOTAL FEED COST 0 TO 2 MONTHS	$ 32.06	
Original Cost of calf	$150.00	
Labor: 8 hours @ $5.50	$ 44.00	
Veterinarian and Veterinary supplies	$ 5.73	
Bedding ($25/ton)	$ 2.25	
Miscellaneous (fuel, insurance, etc.)	$ 2.19	
Interest on Operating Loan (14% for ½ term)	$ 2.24	
Capital Cost (10% + 8% depreciation)**	$ 4.20	
TOTAL OTHER COSTS TO 2 MONTHS	$210.61	
TOTAL COST TO 2 MONTHS		$242.67
2-6 MONTHS, WEIGHT 150-355 POUNDS:		
Concentrate (ration): 400 lbs. @ $7.17 per cwt	$ 28.68	
Hay: 600 lbs. @ $55 per ton	$ 16.50	
TOTAL FEED COST 2 TO 6 MONTHS	$ 45.18	
Labor: 4 hours @ $5.50	$ 22.00	
Bedding	$ 3.00	
Miscellaneous (fuel, insurance, etc.)	$ 1.12	
Capital Cost	$ 8.40	
TOTAL OTHER COSTS 2-6 MONTHS	$ 34.52	
TOTAL COST 2 TO 6 MONTHS	$ 79.70	
TOTAL ACCUMULATED COST TO 6 MONTHS		$332.37
6-12 MONTHS, WEIGHT 355-630 POUNDS:		
Concentrate (rations): 450 lbs. @ $7.17 per cwt	$ 32.26	
Hay: 2,160 lbs. @ $55 per ton	$ 59.40	
TOTAL FEED COST 6-12 MONTHS	$ 91.66	
Labor: 6 hours @ $5.50	$ 33.00	
Bedding	$ 6.75	
Miscellaneous (fuel, insurance, etc.)	$ 5.37	
Interest on Operating Loan	$ 3.63	
Capital Cost	$ 12.60	
TOTAL OTHER COST 6-12 MONTHS	$ 61.35	
TOTAL COST 6 TO 12 MONTHS	$153.01	
TOTAL ACCUMULATED COST TO 12 MONTHS		$485.38

ESTIMATED COSTS TO RAISE HOLSTEIN DAIRY HEIFERS - ALBERTA 1980 CONTINUED*

12-24 MONTHS, WEIGHT 630-1070 POUNDS:	Per Heifer	
Hay and hay equivalent: 4 tons @ $42 per ton	$168.00	
Concentrate (grain): 6 months - 550 lbs. @ $3.90 per cwt	$ 21.45	
Labor: Figured on some pasturing, 7 hrs. @ $5.50	$ 38.50	
Breeding (1.7 services)	$ 23.80	
Bedding	$ 9.00	
Miscellaneous (fuel, insurance, etc.)	$ 10.88	
Interest on Operating Loan	$ 16.32	
Capital Cost	$ 25.20	
TOTAL COST 12 TO 24 MONTHS	$313.15	
TOTAL ACCUMULATED COST TO 24 MONTHS		$798.63
24-27 MONTHS, WEIGHT 1070-1200 POUNDS:		
Hay and hay equivalent: 1.25 tons @ $42 per ton	$ 52.50	
Concentrate (grain): 1 month - 120 lbs. @ $3.90 per cwt	$ 4.68	
Labor: Figures on some pasturing, 2 hrs. @ $5.50	$ 11.00	
Bedding	$ 3.37	
Miscellaneous (fuel, insurance, etc.)	$ 3.04	
Interest on Operating Loan	$ 1.11	
Capital Cost	$ 6.30	
TOTAL COST 24 TO 27 MONTHS	$ 82.00	
TOTAL ACCUMULATED COST TO 27 MONTHS		$880.63

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* Fed until 2 weeks before freshening and total accumulated cost includes the original cost of calf of $150.00.

** The investment cost was based on $140 of investment per calf. The herd size is 50-100 cows.

Source: Production Economics Branch, ADA

Appendix B (Continued)

Estimated Costs to Raise Holstein Dairy Heifers
Alberta 1980 Continued

27-29.5 months, weight 1200-1300 pounds	Per heifer
Hay and hay equivalent: 1.04 tons ($42.00/ton)	$43.68
Concentrate(grain): 2.5 mo.-300 lbs. ($3.90/cwt)	$11.70
Labor: including pasturing, 1.5 hours ($5.50/hr)	$8.25
Bedding	$2.81
Miscellaneous(fuel, insurance, etc)	$2.53
Interest on operating loan	$0.92
Capital cost	$5.25
Total cost 27 to 29.5 months	$75.14
Total accumulated cost to 29.5 months	$955.67

Source: Extrapolated from Susko, R. 1980 Estimated Costs to Raise Holstein Dairy Heifers-Alberta 1980.

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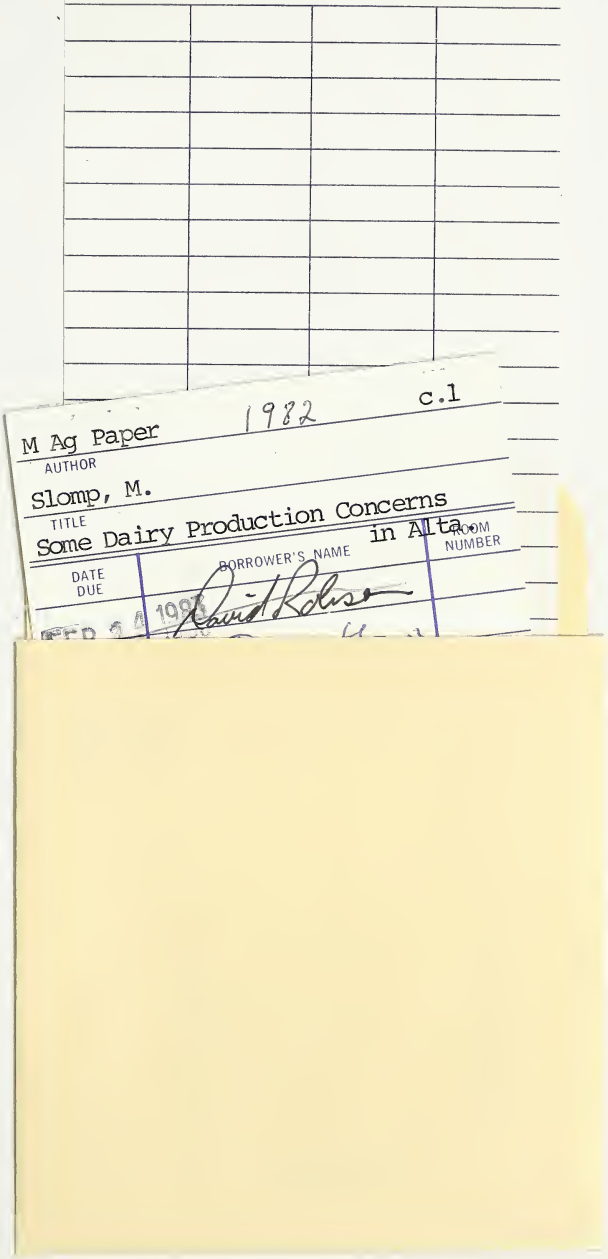

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